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A63B 53/04

(52) UK CL (Edition K)
A6D D23B

(56) Documents cited
GB 2181657 A GB 2172510 A US 4824116 A
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(54) Golf club head

(57) This invention relates to a golf club head comprising a striking plate (20) and a body (30) defining an internal cavity (40) whose volume is occupied by a non-metal filling material (50) and in which the striking plate has a thickness of less than 3 millimetres at least in the impact zone (60). The filling material is generally selected from thermoplastics or elastomer materials. The club may be an iron or a 'wood'.

FIG : 4

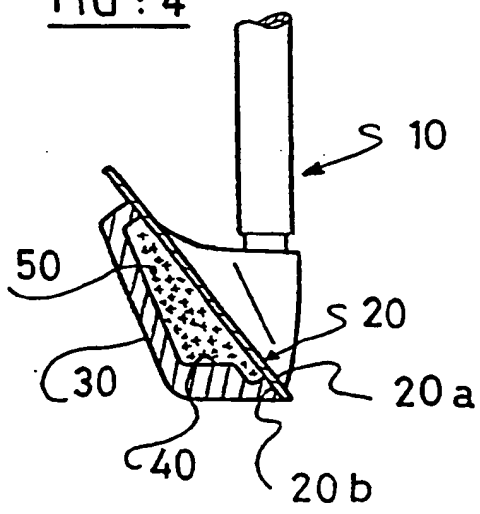

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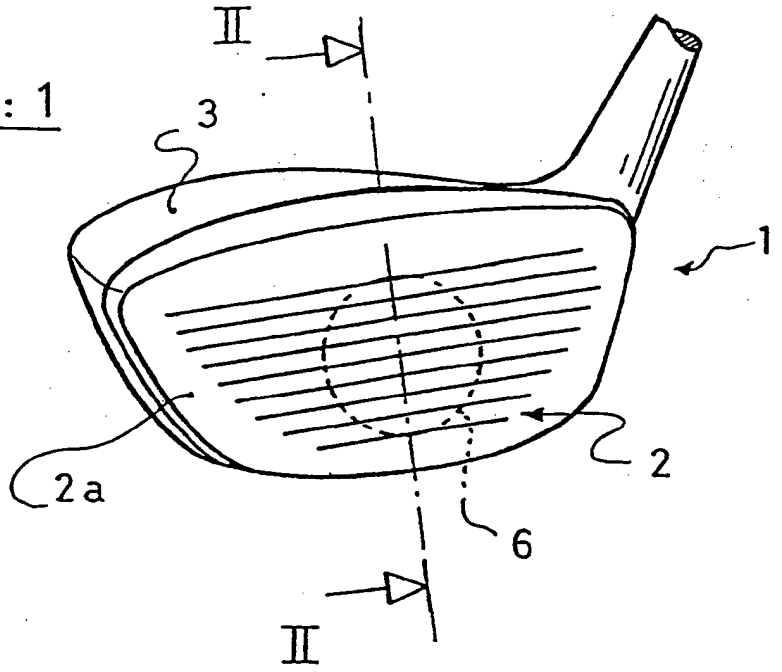
FIG : 1



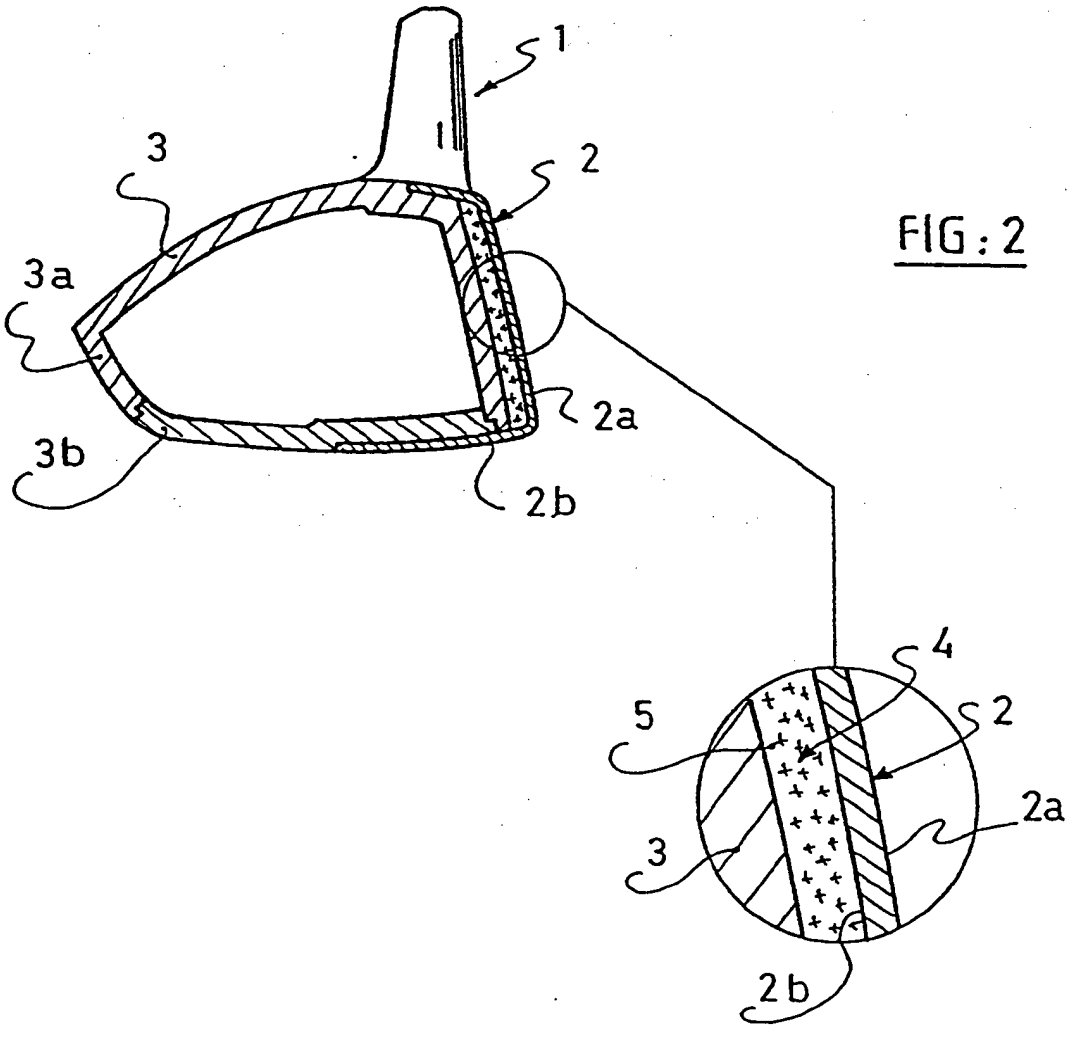


FIG : 2

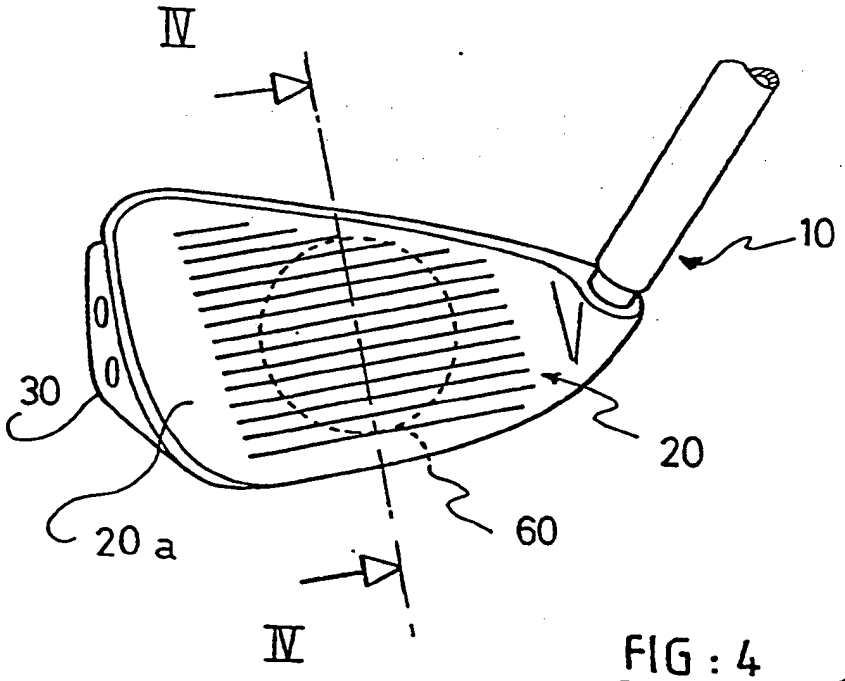


FIG : 3

FIG : 4

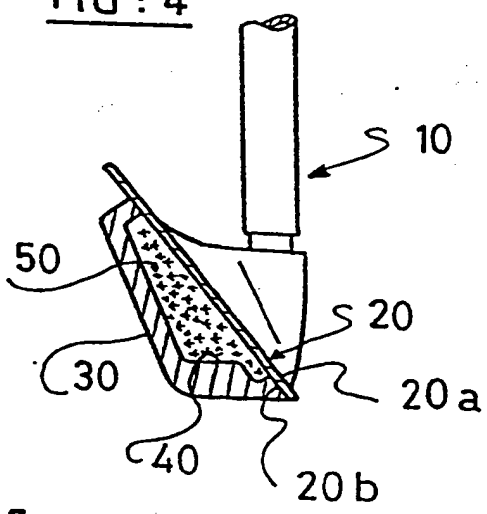
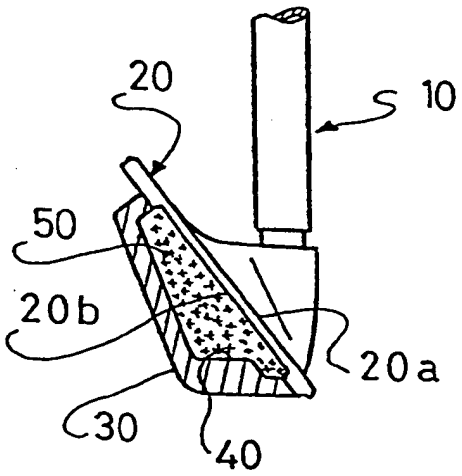


FIG : 5



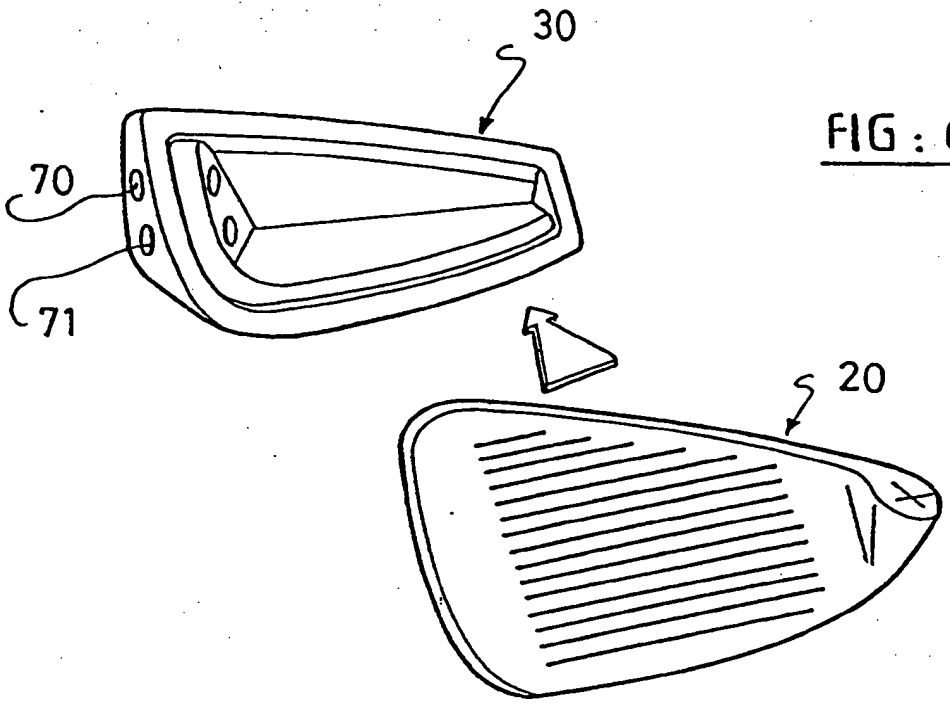


FIG : 6

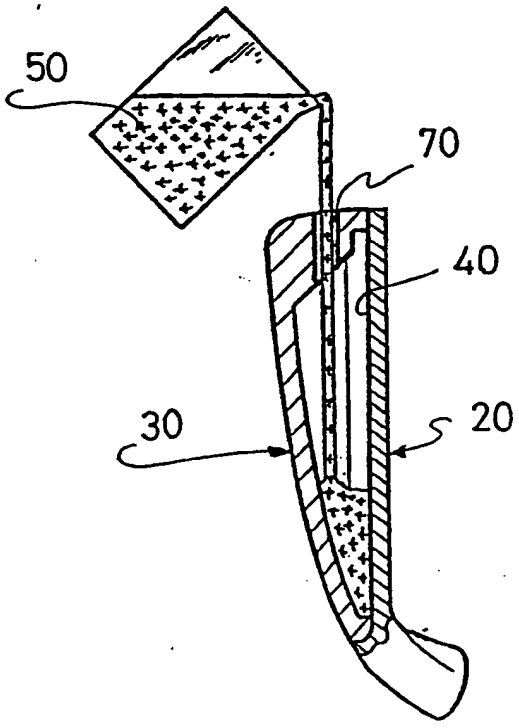


FIG : 7

GOLF CLUB HEAD 2249031

This invention relates to a golf club head.

The technique of forging golf club heads whereby golf club heads are manufactured in a single piece using relatively soft steels has been known for a long time. This traditional technique has the essential advantage that it makes it possible to produce striking faces of great accuracy having an unequalled feel. Conversely it implies a considerable face thickness in order to avoid permanent deformation of the face when the first shot is struck, and this of course has an adverse effect on the cost of such a product. Furthermore this technique only applies to the manufacture of irons, and cannot be used for other clubs such as metal-woods for example.

At the present time lost-wax moulding, the most economical method, makes it possible for heads to be constructed in two parts. The striking plate can be cast separately from the body and the whole is generally welded together. The space left in assembly can be filled by a foam in a cellular condition whose sole function is to attenuate the metallic sound on impact. It is the striking plate which withstands all the stress exerted on impact. Whatever the nature of the material used to manufacture the striking face, it must have a relatively large thickness of between 3

and 5 millimetres. This stress limits the possibilities for distributing masses about the periphery of the plate in order to increase its moment of inertia and thus improve control of the ball. Furthermore the consumption of metal material is high, and costly in the manufacture of mass-produced clubs.

This invention provides a new method of construction for golf club heads applicable to irons or metal-woods whose object is to overcome the aforesaid disadvantages. Thus the main advantages provided by the construction of the invention are measured in terms of savings in materials and in terms of the feeling on impact, particularly the agreeable sound, in contrast with the "hollow" sounds of existing clubs, and also in terms of performance, particularly in improving control of the ball by the possibility of distributing masses about the periphery of the head.

The golf club head according to the invention comprises a metal striking plate and a body forming an internal cavity whose volume is occupied by a non-metal filling material and is characterised in that the said impact plate has a thickness of less than 3 millimetres at least in the impact zone and in that the nature, dimensional, physical or mechanical properties of the filling material make it possible to keep the deformation of the said striking plate below its elastic limit when impacting against a golf ball.

It will easily be understood that the use of a thin face will contribute to significant savings in materials in large scale production. Part at least of this saving may be intelligently used by placing material around the periphery of the face so as to improve the inertia of the club head. Secondarily, the invention makes it possible to use forgeable or stampable soft steels which are particularly valued by

good players.

Other features and advantages of the invention will become clear from the following description with reference to the appended drawings which are given merely by way of non-restrictive examples.

Figure 1 is a view in perspective of a golf club head according to the invention and in particular a metal wood.

Figure 2 is a view in cross-section at the centre of the face and the side of the golf club head in Figure 1.

Figure 3 is a perspective view of a golf club head according to another embodiment of the invention, and in particular of an iron.

Figure 4 is a view in cross-section at the centre of the face and the side of the club head in Figure 3.

Figure 5 is a view in cross-section at the centre of the face and the side of the club head according to a different embodiment to that in Figure 4.

Figure 6 shows a first stage in an example of a method of manufacturing the product in Figures 3 and 4.

Figure 7 shows a second stage in the process of manufacture of the product in Figures 3 and 4.

As shown in Figures 1 and 3 illustrating the head of a wood (1) and an iron (10), the golf club head according to the invention comprises a striking plate (2,20). This striking plate (2,20) consists of an outer face or striking face (2a, 20a) on which a substantially circular impact zone (6,60) (in dashed lines on the figures) in which the majority of points of impact with the ball are concentrated can be defined. This zone is mainly centred on the face and

has a diameter which does not generally exceed that of a golf ball.

As illustrated in Figures 2 and 4, the metal striking plate (2,20) also comprises an inner face (2b, 20b) to which a metal body (3,30) is attached. Assembly of the body onto the plate leaves an internal cavity (4,40) whose volume is occupied by a non-metal filling material (5,50). In the impact zone (6,60) the striking plate is selected to be thin, with a thickness of less than 3 millimetres, regardless of its strength.

For reasons of ease of construction the striking plate preferably has a constant thickness.

Figure 2 illustrates a particularly advantageous embodiment in which the filling material (5) forms a layer of substantially constant thickness of plastics material having a thickness of not more than 3 millimetres and a shore D hardness of between 20 and 70.

In this example, association of these two parameters, hardness and thickness, makes it possible for this layer (5) resting against the attached metal body (3) which acts as a support to keep the deformation of the impact plate (2) below its elastic limit when impacting with a ball. The filling material may be a thermoplastics or elastomer material. By way of example the possibility of using a layer of PEBA (polyether-block amide) may be quoted. In the manner of construction in Figure 2 the striking plate preferably has a thickness of between 1 and 2 millimetres for a breaking strength of between 50 and 80 daN/mm2. It is selected from steel sheet or steel alloy which for example can easily be deformed by swaging or cold forging.

This construction is particularly and advantageously suitable for the heads of woods called

metal-woods. The total volume is in fact large and cannot be entirely filled by a filling material acting as a support for a thin striking plate otherwise a head of too great a mass is obtained.

Thus the attached metal body (3) is preferably hollow as illustrated in Figure 2 and made from the assembly of an upper body 3a preferably of moulded aluminium with a lower body or sole 3b of a similar material.

The components are assembled together by screwing, riveting or any other means well known to those skilled in the art.

A second embodiment of the construction of a club head according to the invention is illustrated for example by Figures 3 and 4 which show the head of an iron (10). Cavity (40) formed by assembly of the striking plate (20) with the attached metal body (30) is wholly filled by the filling material (50). Because of the thinness of the striking plate (20), the filling material (50) must have low compressibility and/or high rigidity properties. The compressibility of a material is measured by its Poisson coefficient and its rigidity by its compression modulus. The filling materials according to the invention are selected from solid plastics materials with very little compressibility having a Poisson coefficient lying between 0.5 and 0.35 and/or rigid solid plastics materials whose compression modulus is equal to at least 1000 MPa.

The materials fulfilling these characteristics are generally special polymers of the elastomer type. It will be noted that elastomeric polyurethanes, sequenced polybutadiene styrenes, vulcanised or thermoplastic rubbers (e.g. EPDM, EVA), silicones and sequenced polyamides may be used. Of these elastomers those which can be worked by the RIM (Reaction Injection Moulding) process are preferred.

For the purposes of balancing, the filling material can of course be weighted with high density metal particles or balls.

The invention as described above of course includes numerous variant embodiments such as that illustrated in Figure 5 in which the striking plate (20) is thin and constant only in the zone where the filling material (50) is in contact with the inner wall (20b) of the striking plate (20). The plate in contact with the attached hollow body (30) should in fact be sufficiently thick to be correctly welded. Likewise this construction makes it possible for the masses due to the thickness of the material to be usefully distributed about the periphery of the plate thus making it possible to achieve a considerable increase in the moment of inertia of the head.

The solid filling material (20) may also be replaced by a liquid whose incompressibility measured by the volume compressibility modulus is not less than 2100 MPa (this value is identical to that of water which is regarded as a virtually incompressible substance).

The example in Figures 3 and 4 relates more particularly to irons, as mentioned previously, and it is therefore advantageous to be able to select a striking plate of a forgeable and thus relatively soft steel, or on the contrary of a mouldable steel whose mechanical properties are better, but to the detriment of the accuracy of the construction of the face. However in both cases it is of course necessary to use a filling material which acts as a support in order to prevent the plate from collapsing because of its thinness.

Figures 6 and 7 illustrate an example of a particularly advantageous method of manufacture implementing the invention. This takes place in 3

separate stages.

- A first stage consists of making the striking plate (20) and the attached body (30) separately.

- A second stage consists of assembling and welding these two units (20,30) together, as shown in Figure 6.

- A third stage consists of introducing filling material 50 by low pressure pouring or by gravity in the RIM process through a filling orifice (70,71) which communicates with the internal cavity (40), followed by sealing the orifice (70,71).

In general the manner of implementing the invention which has just been described represents only one non-restrictive example of which numerous variants can be envisaged without thereby going beyond the scope of this invention. For example the metal striking plate and body could be formed in one piece instead of being made separately.

CLAIMS:

1. A golf club head comprising a metal striking plate and a body defining an internal cavity whose volume is occupied by a non-metallic filling material, wherein the striking plate has a thickness of less than 3 millimetres at least in the impact zone, and the nature, the dimensional, physical and/or mechanical properties of the filling material make it possible to keep the deformation of the striking plate below its elastic limit when impacting against a golf ball.

2. A golf club head according to claim 1, wherein the filling material forms a layer of plastics material of substantially constant thickness not exceeding 3 millimetres and of a shore D hardness of between 20 and 70.

3. A golf club head according to claim 1 or 2, wherein the striking plate is of steel or steel alloy.

4. A golf club head according to claim 1, 2 or 3, wherein the striking plate has a thickness of between 1 and 2 millimetres and a breaking strength of between 50 and 80 daN/mm^2.

5. A golf club head according to any one of claims 1 to 4, wherein the filling material is a thermoplastics or elastomer material.

6. A golf club head according to any one of claims 1 to 5, wherein the head is the head of a metal wood.

7. A golf club head according to claim 1,

wherein the filling material is a poorly compressible solid plastics material whose Poisson coefficient lies between 0.5 and 0.35 and/or rigid material whose compression modulus is not less than 1000 MPa.

8. A golf club head according to claim 1, wherein the filling material is a liquid whose volume compressibility modulus is not less than 2100 MPa.

9. A golf club head according to claim 7, wherein the filling material comprises an elastomer.

10. A golf club head according to claim 9, wherein the filling material is capable of being worked by a Reaction Injection Moulding (RIM) process.

11. A golf club head according to any one of claims 7 to 10, wherein the filling material is weighted with high density metal particles or balls.

12. A golf club head according to any one of claims 7 to 11, wherein the metal striking plate and body are formed separately and fastened together to define the internal cavity.

13. A golf club head according to any one of the foregoing claims, wherein the body is made of metal.

14. A golf club head according to any one of claims 1 to 5 or 7 to 13, wherein the head is the head of an iron.

15. A golf club head substantially as herein described with reference to the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroll r under Section 17 (The Search Report)

Application number
9121728.1

Relevant Technical fields

(i) UK Cl (Edition K) A6D (D23B)

(ii) Int Cl (Edition 5) A63B 53/04

Search Examiner
D WHITFIELD

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES:- WPI

Date of Search
27 NOVEMBER 1991

Documents considered relevant following a search in respect of claims 1-15

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 2181657 A (MARUMAN) See page 3 lines 16-24 & 83-87	1, 3, 4, 13
X	US 4319752 (THOMPSON) See column 3 lines 49-52	1, 3-6, 9, 10, 12
X	US 4214754 (ZEBELEAN) See column 4 lines 17-46	1, 3-6, 9, 10, 12
Y	US 4824116 (YAMAHA) Whole document	1, 3-6, 9, 10, 12
Y	GB 2172510 A (YONEX) Whole document	1, 3-6, 9, 10, 12

Category	Identity of document and relevant passages	Relevant to claim(s)

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